Measurement of the Earth Radiation Imbalance

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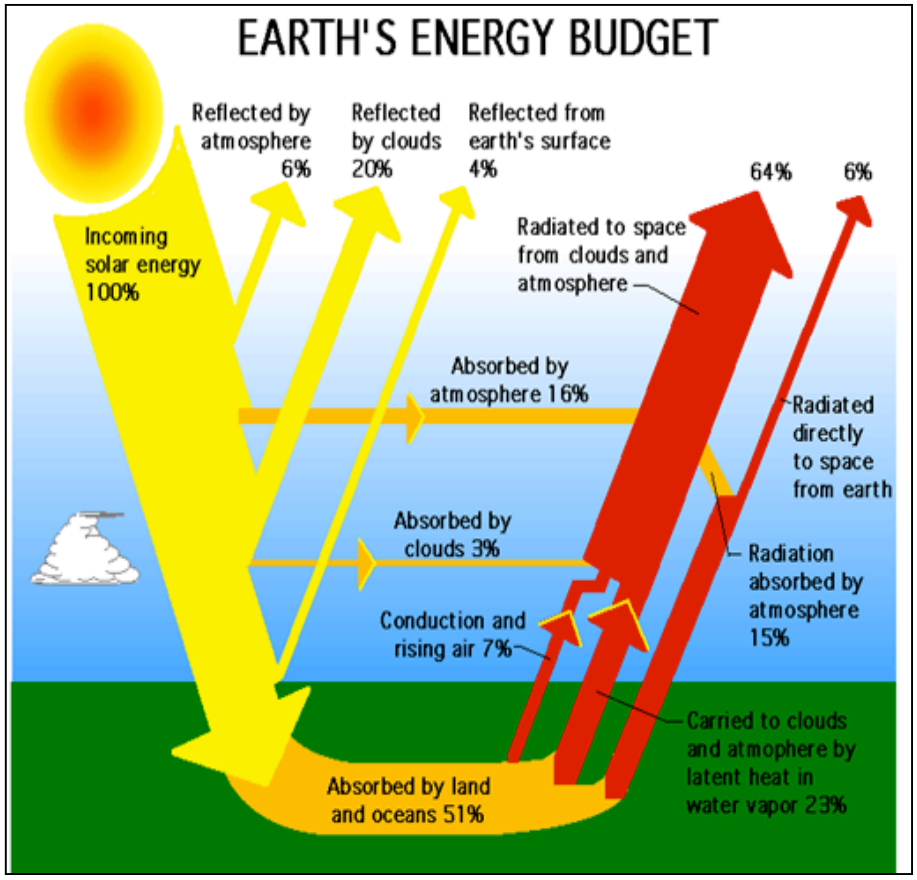
Earth Radiation Imbalance (W/m²)

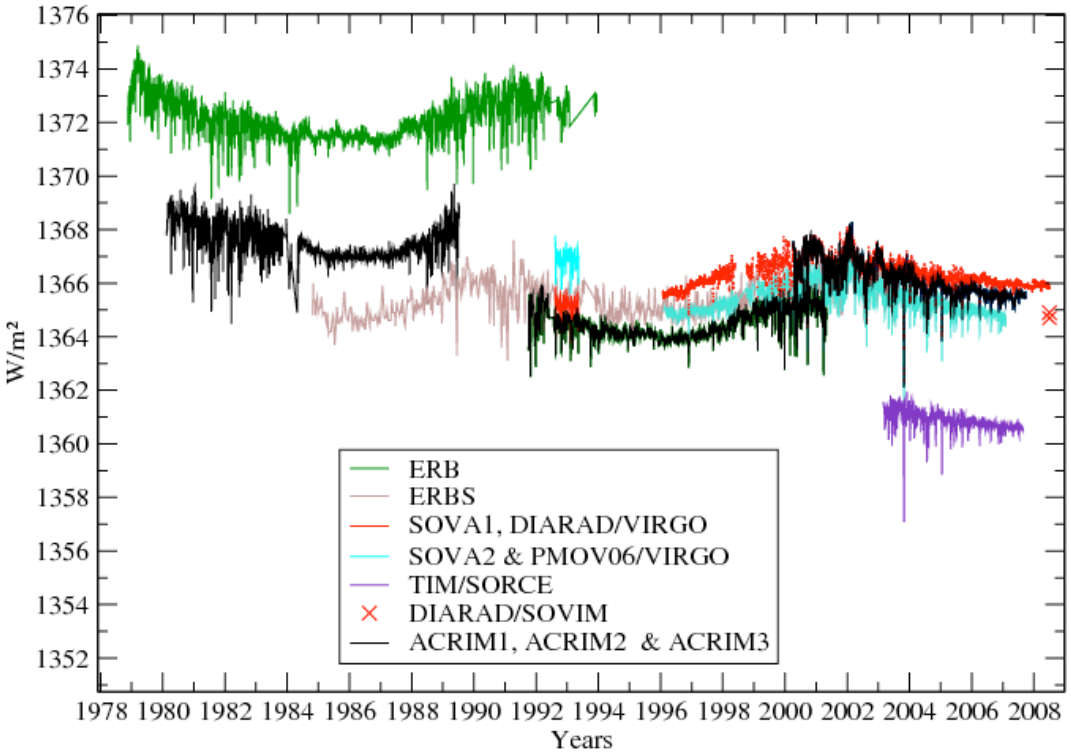
341 -102 - 238 = 1



Challenges in the measurement of the Earth Radiation Imbalance

- CALIBRATION: UNDERESTIMATED PROBLEM
- Sampling
  - Spatial -> use of scanners instead of non-scanners
  - Temporal -> GERB
  - Angular -> ADM improvements
  - Spectral -> spectral response, unfiltering

Independent Total Solar Irradiance measurements



Incoming solar

- For period 03/2000-02/2005 (CERES EBAF):
- Min=TIM, Max=DIARAD/VIRGO
- TSI = 1364.12 +/- 2.5 W/m² (0.2%)
- Incoming solar: 341.3 +/- 0.63 W/m²

GERB2/CERES SW Radiance Ratio

- June + Dec 2004:
- GERB 2 / CERES : 1.059
- GERB 2 / CERES FM1: 1.045
- GERB 2 / CERES FM2: 1.054
- GERB 2 / CERES FM3: 1.071
- GERB 2 / CERES FM4: 1.067

- Preliminary: GERB 2 / GERB 1 ~ 1.03

Reflected solar

- Min = CERES FM3
- Max = GERB2
- For period 03/2000-02/2005 (CERES EBAF):
- Reflected solar = 98.71 +/- 3.38 W/m² (3.4%)

GERB2/CERES LW Radiance Ratio

- June + Dec 2004:
- GERB 2 / CERES: 0.987
- GERB 2 / CERES FM1: 0.989
- GERB 2 / CERES FM2: 0.993
- GERB 2 / CERES FM3: 0.983
- GERB 2 / CERES FM4: 0.981

- Preliminary: GERB 2 / GERB 1 ~ 0.995

Emitted thermal

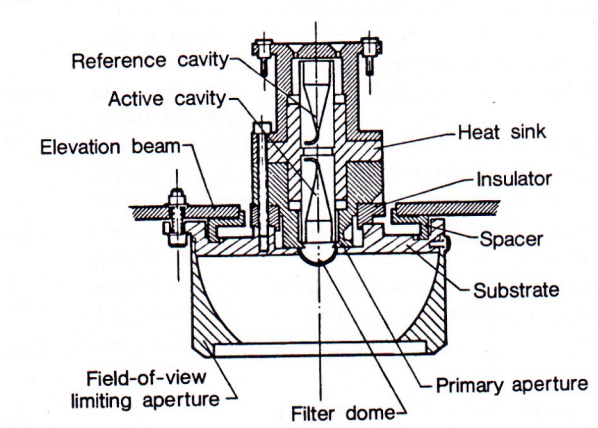
- Min= GERB2
- Max=CERES FM4
- For period 03/2000-02/2005 (CERES EBAF):
- Emitted thermal: 236.76 +/- 2.27 W/m² (1%)

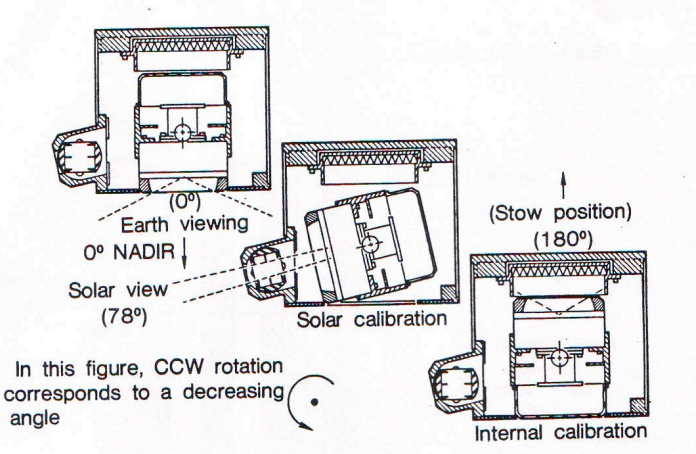
Earth Radiation Imbalance

- Measured = 5.55 +/- 6.28 W/m²
- Expected = 0.85 W/m²

- Insufficient accuracy
- Only possibility for significant improvement: measure Sun and Earth radiation with single instrument

ERBE wide field of view radiometers





- Spectrally flat and true flux measurement
- Separate measurements of Sun and Earth
- See presentation Nancy Vermeulen @ GIST meeting

WFOV Results 1985-1991

- Earth radiation imbalance = 8.27 W/m² +/- 0.35 W/m²
- Uncertainty due to sampling
- Missing instrument uncertainty

- Still not satisfactory
- Instrument design improvements are possible

Proposal for building new instrument

- Build new Wide Field of View cavity radiometer as reference for the true measurement of the Earth Radiation Imbalance
- We have the know-how based on the experience with the DIARAD TSI radiometers
- We are interested in Clarreo flight opportunity

Conclusions

- For a true measurement of the Earth Radiation Imbalance we should focus on CALIBRATION.
- The only possibility is to measure the Earth and Sun fluxes WITH ONE INSTRUMENT.
- Adding spatial and spectral resolution will not help ...